

Motion Demonstrations Lesson Plan
8th grade Physical Science
Day 1

SOLs:

PS. 10 The Student will investigate and understand scientific principles and technological applications of work, force, and motion. Key concepts include
a) speed, velocity, and acceleration;

Objectives:

- Students will know the definitions of speed, velocity, distance, displacement, and acceleration.
- Students will know the difference between speed and velocity.
- Students will know the difference between distance and displacement.
- Students will know which units are SI units.
- Students will know that mass does not affect an object's rate of falling.

Materials:

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|------------------------------|------------------------------------|
| • misconception questions | • wood block |
| • powerpoint presentation | • tabletop |
| • clickers | • 2 ramps + blocks to prop them up |
| • computer & projector | • 2 cars |
| • ELMO | • timer |
| • worksheet for taking notes | • skateboard |
| • quarters | • medicine ball |

1. Introduction:

- “Now we start kinematics, which is basically just a big word for motion.”
- We will begin with clicker questions that target specific misconceptions that we will correct with the demonstrations and subsequent lecture/notes.

2. Demonstrations:

- Things fall at the same rate.
 - We will drop two objects (2 quarters taped together and 10 quarters taped together).
 - Question: Which object weighs more?
 - Expected Answer: ten quarters
 - Question: Which do you think will drop faster?

- Expected Answer: ten quarters
 - After demo- the students will be able to see that they dropped at the same time, explain that this is because they are both accelerating due to gravity
- Friction (sliding blocks)
 - Newton's second law states that things in motion tend to stay in motion, so why does everything slow down? Friction.
 - Teacher will slide things along two surfaces with different coefficients of friction and show how one slows down more.
- Skateboard (conservation of momentum)
 - To show Newton's 3rd law: sitting on a skateboard and throwing something will cause you to move (action/reaction)
 - Teacher stands on skateboard holding medicine balls (teach + balls at rest)
 - Teacher throws the balls forward & starts moving backward, conservation of momentum.
 - Relate to outer space & friction:
 - If you were floating in outer space (no gravity and no friction, if you throw a ball: a) you will go in the opposite direction and b) the ball will fly in a straight path in the direction you threw it until it gets hit by an asteroid or gets pulled into a planet's gravitational field.
- Acceleration (ramps)
 - We will show how the incline of a ramp affects the speed of a ball rolling down even though the ramps are the same length.
 - Questions: Are these ramps any different?
 - Are they the same length? - no
 - Are these cars any different? - no
 - Start with ramps at the same height, show that if you let go of the cars at the same time they will reach the bottom at the same time.
 - Then raise one ramp higher than the other.
 - Ask the students what they think will happen – if they say that the more inclined ramp will roll faster, ask “Why? Don't the cars go the same distance?”
 - Introduce acceleration. Example: gravity

3. Notes: (Fill out on the ELMO w/ the class)

- Teacher questions students to see if they know the definitions, and corrects any misconceptions before writing the correct definition and draws pictures to make each term clearer.

- Questions for the students are in *italics*. They are meant to elicit students' prior knowledge so that students can help construct the correct definition.
- Text in blue indicates the definitions the teacher will write in

What is motion?

Q: How do you know when something is in motion?

An object is in motion when its distance from another object is changing.

reference point – a place or object used for comparison to determine motion

Measurements:

Q: What types of units do you see everyday?

SI units

International system of units:
meters, kilograms, seconds

Q: Is there a difference between distance and displacement?

distance – the interval between two locations along the actual path

displacement – change in position; the shortest path between locations.

(draw picture to show difference)

Q: What is speed? What units do you normally see speed in? What would the SI units for speed be?

speed – the distance an object travels in a unit of time

$$\text{speed} = \frac{\text{distance}}{\text{time}}$$

Q: Does anyone know the difference between speed and velocity?

velocity – speed in a specific direction

Q: What is acceleration?

acceleration – the rate at which velocity changes

$$\text{acceleration} = \frac{\text{final velocity} - \text{initial velocity}}{\text{time}}$$

Q: How do you know if velocity is changing?

Expected Answer: If the object is speeding up, slowing down, or changing direction

4. Practice problems

Textbook pg. 308, #1-5, 12

- Students have 7 minutes to work through the problems on their own, then they have 3 minutes to compare answers at their tables before we go over them as a class.

5. Conclusion:

- Connecting the demonstrations to the content.
- Go over the correct answers to the questions in the beginning.
 - Ask students again what the answers are, if there is still confusion have one student who understands it explain to the students who are still confused.
- Looking ahead... Newton's Laws tomorrow
- Exit slip: Write down a question about motion you want to know the answer to.
 - Teacher will read their responses and incorporate them into the next day's lesson